Cowpea (Vigna unguiculata) forage

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Common names

Cowpea, asparagus bean, black-eyed pea, catjang, catjang cowpea, Chinese long bean, clay pea, cow-pea, cream pea, crowder pea, pea bean, purple-hull pea, southern pea, sow pea, yard-long bean [English]; dolique asperge, dolique mongette, haricot asperge, haricot indigène, niébé, pois à vaches [French]; feijão-espargo, feijão-fradinho [Portuguese]; costeño, frijol de costa, judía catjang, judía espárrago, rabiza [Spanish]; اللوبياء [Arabic]; adua, ayi, too, tipielega, yo, tuya, saau [Ghana]; wake, ezo, nyebbe, ngalo, azzo, dijok, alev, arebe, lubia, mongo, ewa, akedi, akoti [Nigeria]; kunde [Swahili]; Kedesche, sona, kadje, tombing, isanje [Togo]; imbumba, indumba, isihlumaya [Zulu]; kacang bol, kacang merah, kacang toonggak, kacang béngkok [Indonesian]; đậu dải, đậu dải trắng rốn nâu [Vietnamese]

- Cowpea forage, cowpea fodder, cowpea hay, cowpea silage
- Cowpea haulms
- Cowpea pod husks

Species

Vigna unguiculata (L.) Walp. [Fabaceae]

Synonyms

Dolichos biflorus L., *Dolichos catjang* Burm. f., *Dolichos hastifolius* Schnizl., *Dolichos lubia* Forssk., *Dolichos melanophtalmus* DC., *Dolichos melanophthalamus* DC., *Dolichos monachalis* Brot., *Dolichos obliquifolius* Schnizl., *Dolichos sinensis* L., *Dolichos tranquebaricus* Jacq., *Dolichos unguiculatus* L., *Liebrechtsia scabra* De Wild., *Phaseolus sphaerospermus* L., *Phaseolus unguiculatus* (L.) Piper, *Vigna brachycalyx* Baker f., *Vigna catjang* (Burm. f.) Walp., *Vigna catjiang* (Burm. f.) Walp., *Vigna scabra* (De Wild.) T. Durand & H. Durand, *Vigna scabrida* Burtt Davy, *Vigna sinensis* (L.) Savi ex Hausskn., *Vigna sinensis* (L.) Savi ex Hausskn. var. *catiang* sensu Chiov., *Vigna sinensis* (L.) Savi ex Hausskn. subsp. *sinensis* (L.)Hassk., *Vigna sinensis* (L.) Savi ex Hausskn. var. *spontanea* Schweinf., *Vigna unguiculata* (L.) Walp., *Vigna unguiculata* (L.) Walp. subsp. *dekindtiana* sensu Verdc. (ILDIS, 2009)

Feed categories

- Legume forages
- Forage plants

Related feed(s)

- Cowpea (Vigna unguiculata) seeds

Description

The cowpea (*Vigna unguiculata* (L.) Walp.) is an annual herbaceous legume cultivated for its edible seeds or for fodder. It may be climbing and erect, as well as prostrate and creeping depending on the cultivar. Prostrate varieties grow to about 80 cm and climbing cultivars up to 2 m. It has a well developed root system. The leaves are trifoliate with oval leaflets, 6-15 cm long and 4-11 cm broad. The papillonaceous flowers can be white, yellowish, pale blue or violet and are distributed along axillary clusters. Pods occur in pairs forming a V, mostly pendulous but they can be erect. They are cylindrical, 6 to 20 cm long and 3-12 mm broad, and contain 8 to 20 seeds. Seeds can be white, pink, brown or black.

The cowpea is one of the most popular legume grains in Africa and is also cultivated in some parts of America and Asia. Cowpea is called the "hungry-season crop" because it is the first harvested crop, before the cereal crops. Its seeds, pods and leaves are commonly used as human food. Cowpea has great flexibility in use: farmers can choose to harvest it for grains or as forage for their livestock, depending on economic or climatic constraints (Gomez, 2004). Dual-purpose varieties have been developed to provide both grain and fodder while suiting the different cropping systems encountered in Africa (Tarawali et al., 1997).

Cowpeas are primarily valued as food, but they are occasionally used to feed livestock. Cowpea forage, both the vines and leaves, either fresh, or conserved as hay or silage, is often used for fodder. There have been attempts at using cowpea leaf meal in pig feeding. The haulms, which are the crop residues of seed production, contain about 45-65% stems and 35-50% leaves and sometimes roots (Anele et al., 2012), and are an important by-product in Sub-Saharan Africa (Singh et al., 2010; Savadogo et al., 2000a). Cowpea pod husks obtained after threshing are also used to feed livestock (Oluokun, 2005).

Distribution

Cowpea is native to central Africa. It is widespread throughout the tropics and in most tropical areas between 40°N to 30°S and below an altitude of 2000 m (Ecocrop, 2009). Cowpea is grown in more than two-thirds of the developing world as a companion or relay crop with major cereals crop (Tarawali et al., 1997). In 1996, the total world area was about 12 million ha,

and Africa alone accounted for over 8 million ha, of which about 70% were in West and Central Africa (Singh et al., 1996). In other regions, notably in Australia and Asia, cowpea is primarily a fodder crop, but is also used for green manure or as a cover crop (Tarawali et al., 1997).

Cowpea grows in savannah vegetation, at temperatures ranging from 25°C to 35°C, and in areas where annual rainfall ranges from 750 mm to 1100 mm (Madamba et al., 2006). Cowpea is tolerant of shading and can be combined with tall cereal plants such as sorghum and maize (FAO, 2013). Cowpea grows on a wide range of soils provided they are well drained (Madamba et al., 2006). It is sensitive to waterlogging, though less so than other legumes (Ecocrop, 2009). High moisture may hinder cowpea crops in the sub-humid tropics due to the many diseases they are susceptible to (Tarawali et al., 1997).

Forage management

Yields

Cowpea can produce good yields of high quality dry matter. Under dry land conditions, yields of cowpea forage have ranged from 0.5 t DM/ha to over 4 t DM/ha under favourable conditions. Production per season is usually 2 to 3 t DM/ha. Yields of up to 8 t DM/ha have been recorded in irrigated areas (Mullen, 1999). Cowpea does well in association with cereal crops through intercropping. In Africa, cowpea is widely intercropped with maize, sorghum and millet (Cook et al., 2005). Farmers may harvest up to 0.4 t/ha of cowpea leaves in a few cuts with no noticeable reduction in seed yield. A potential yield of 4 t/ha of hay can be achieved with good management from a pure stand of cowpea. However, the world average yield of cowpea fodder is 0.5 t/ha (air-dried leafy stems) (Madamba et al., 2006).

Cowpea pasture and cut-and-carry systems

Cowpea pastures and cut-and-carry systems are well developed in Asia and Australia. In Australia, cowpea forage is considered as an annual forage whose quality is at his best during summer and autumn (Davies, 1960 cited by Tarawali et al., 1997). When seasons are suitable, and when sown relatively early, the best forage types will regrow after grazing or cutting.

In Kansas, cowpea was used for pasture in the early 20th century. It provided succulent feed during late summer when natural pastures were short. Used with maize, it was a high grade forage for pigs and sheep. Livestock had to be turned on cowpeas when the plant was fully developed (yellow pods) in order to prevent trampling and to provide its full feeding value. Cattle entered the swards before sheep and pigs, which allowed the latter animals to graze ripe cowpeas. The best feeding value was obtained in stands where cowpeas were intercropped with maize. In the drier parts of Kansas, it was suggested to intercrop cowpea with wheat or oats rather than maize (Teyneyck et al., 1909).

Grazing should be light to ensure that most of the plant is preserved and damage is limited (Cook et al., 2005). Cowpea may suffer from trampling if livestock enter the sward before the plants are full-grown. To prevent this, cowpeas can be used for zero grazing or can be grazed by pigs before cattle or sheep. Yields of fresh fodder can be increased by cutting the plants two or three times in a season. In Afghanistan, under irrigation, it is recommended to make the first cut after 60-65 days from sowing, the second cut 45-55 days later and the third cut 50 days later (Oushy, 2012). When cut, cowpea can be mixed with dry cereals for stall-feeding (Tarawali et al., 1997).

Cowpea hay

In West Africa, cowpea hay is an important fodder sold in local markets. In smallholder systems, when used as a dual-purpose legume, cowpea hay can be used as animal feed. Cowpea can also be grown with Sudan grass for hay. When cowpea is grown specifically for hay, cowpea hay can be of similar quality to alfalfa hay. Hay yields are generally 3-5 t/ha. Hay quality declines as the crop matures (Cook et al., 2005). When cowpea is specifically grown for hay, cutting should be done when 25% of the pods are coloured (Van Rij, 1999). In Australia, the ideal time to cut a cowpea crop for hay is at peak flowering, which occurs 70-90 days after sowing (Cameron, 2003).

Cowpea haulms

Well-cured cowpea haulms are a useful feed and can make excellent hay, provided that the leaves are well preserved (too much exposure to the sun makes them fall off) and that the stems are adequately wilted (Cook et al., 2005; FAO, 2013; Göhl, 1982). In Africa, cowpea is primarily grown for seeds and thus harvested when 75-80% of pods are dry, approximately 120-150 days after planting (Van Rij, 1999). Successful harvesting is very dependent on suitable weather and often the leaves are diseased or senescent at the time of harvest (Suttie, 2000).

Cowpea silage

Ensiling cowpea alone is not recommended as it is too moist. However, excellent silage can be made by harvesting a mixed crop of cowpea and forage sorghum, millet or maize (Cook et al., 2005; Göhl, 1982). The ability of cowpea to grow well in a maize crop and to climb the stems of maize makes harvesting both crops together possible (Teyneyck et al., 1909). The intercropping of maize and cowpea at a seed ratio of 75:25; 70:30 or 50:50 has been reported in Iran, Pakistan and Kansas to increase whole fodder production and to produce quality silage (Dahmardeh et al., 2009b; Azim et al., 2000; Teyneyck et al., 1909). Cowpea haulms (vines) can be used to make silage through the addition of water and 5% molasses. This ensiling process enhanced feed value but was not sufficient to fulfill the requirements of goats (Solaiman, 2007)

Environmental impact

Soil improver

An N-fixing legume, cowpea can be included in crop rotations to increase soil nitrogen. Cowpea is particularly useful for building up fertility in soils that have been run down from overcropping. When the crop is fully nodulated, cowpea can fix 20 to 140 kg residual N/ha into the soil. This gives a significant bonus to later cereal crops in the rotation (Mullen, 1999). Cowpea forage helps to eliminate the need for a fallow period between a sorghum crop and the following wheat crop, while providing cover to the soil during summer without demanding too much water (Ledbetter, 2005).

As a cover crop, cowpea can be incorporated into the soil at any time when sufficient green material is available, but this is best done at peak flowering (Cameron, 2003). Cowpea forage has a relatively low C:N ratio and N is quickly mineralized. It is thus a valuable green manure where it is intended to provide readily available, biologically-fixed N for subsequent crops (Creamer et al., 1999).

Weed and disease cycle breaker

Cowpea should be sown in rotation with a grass crop to minimize weed and disease build-up (Mullen, 1999).

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- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

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Nutritional attributes

Cowpea provides a high quality forage, rich in protein (14-24% DM). Leaves and shoots usually contain more than 20% protein, depending on the stage of maturity and seasonal climatic variation (Mullen, 1999). Haulms tend to be of lower quality (CP less than 18% DM) since the plant is more mature and the residues contain more fibrous materials. There are seasonal differences in the quality of haulms so that attention must be given to handling of haulms to minimize the amount of leaves lost during the wet season (Anele et al., 2012). Indeed, protein content differs widely between leaves (22% DM) and stems (8% DM) (Mullen, 1999; Singh et al., 2010). Cowpea pod husks are characterized by a high level of crude fibre (about 31% DM) and a relatively low level of protein (12-13%) (Oluokun, 2005).

Potential constraints

Bloat

As with many green-pasture crops, grazing cowpea may cause bloat in sheep or cattle. This may occur when hungry livestock enter the sward. However, the danger is far less than with alfalfa, and decreases as cowpea becomes more mature (Mullen, 1999).

Photosensitization

Cowpea forage can cause photosensitivity around the face and ears in a small percentage of sheep, particularly crossbred lambs, but this is not considered a major or regular problem (Mullen, 1999).

Ruminants

Cowpea forage is a source of protein and is quite digestible for ruminants (OM digestibility more than 60%) (Anele et al., 2011a; Cook et al., 2005). It is suitable for growing, fattening and lactating animals, including dairy cows (Mullen, 1999). Dual-purpose varieties, although lower in protein than forage-type varieties, require little or no input, and provide sufficient biomass in marginal lands, without additional fertilizer, to provide a livestock feed supplement during the dry season (Anele et al., 2011a). Maize-cowpea intercrops may have considerable potential as forage: intercrops have a higher DM digestibility than maize or cowpea grown alone, they are richer in protein than maize alone and are higher in water-soluble carbohydrates than cowpea alone. The optimum forage quality occurs at the milky stage (Dahmardeh et al., 2009a). Because animals tend to consume selectively the leafy parts, intake decreases as leaf availability declines, which highlights the importance of the leaf component for yield, quality and animal production (Mullen, 1999).

Cowpea haulms

Cowpea haulms can provide adequate protein and energy to sustain ruminant production during an extended dry season (Anele et al., 2011b). They are often used for sheep as a supplement for poor quality basal diets (Anele et al., 2010). DM digestibility is about 65-70% (Karachi et al., 2004; Savadogo et al., 2000b), and differs greatly between leaves (60-75%) and stems (50-60%). Because of this difference, the proportions of leaves and stems in the haulm directly affect its nutritional value (Mullen, 1999; Singh et al., 2010).

Most studies on cowpea haulms have been done with sheep given the haulms to supplement roughage-based diets. Intake of cowpea haulms by sheep can reach 86 g OM/kg $BW^{0.75}$/d, and the selective consumption of leaves results in higher intakes of protein and digestible OM than expected from the offered haulms (Savadogo et al., 2000a). Rams ate up to 60 g OM/kg $BW^{0.75}$/d of cowpea haulms as a supplement to sorghum stover. Although supplementation decreased total DM intake, this was compensated by an increase in stover digestibility (Savadogo et al., 2000b). In sheep fed 200-400 g/d of cowpea haulms as a supplement to a basal diet of sorghum stover, the resulting average live-weight gain (80 g/d) was twice that obtained with sorghum fodder alone (Singh et al., 2003). In male Ethiopian Highland sheep, supplementation of maize stover with cowpea haulms (150 or 300 g DM/d) improved DM and protein intake, OM digestibility, average daily gain, final live weight, carcass cold weight and dressing percentage. Because the N retention, as a percentage of N intake, was higher when cowpeas were offered at a low level, it may increase efficiency to offer smaller quantities over an increased period, especially where resources are limited (Koralagama et al., 2008). Cowpea haulms were used as a supplement for West African dwarf sheep fed a basal diet of *Pennisetum purpureum* (Anele et al., 2010).

Whole cowpea plant

Cowpea can be used as whole plant. Its digestibility appears to vary little with the crop maturity or environmental changes (Mullen, 1999).

Cowpea pasture

In Australia, cowpea was intensively grazed by steers without any adverse effect on live-weight gain during late summer to early autumn (1200 kg/ha/d) (Holzknecht et al., 2000). However, in India, cowpea did not regrow adequately to provide late autumn grazing (Singh et al., 2010). In the South-East USA, cowpea was incorporated in a subtropical grass pasture for grazing cows and calves, but did not persist in July and August (Vendramini et al., 2012).

Cowpea silage

Intercropping of maize and cowpea at a seed ratio of 70:30 increased fodder production and produced silage of high digestibility (higher than maize silage alone supplemented with urea) when harvested at the heading stage, *i.e.* about 35% DM (Azim et al., 2000).

Cowpea hay

In Ethiopia, in crossbred growing steers, cowpea hay was given at 1.5 kg (30% diet) to supplement a hay diet, and resulted in live-weight gain of nearly 250 g/d (Varvikko et al., 1992). Fed to steers at 1% of body weight in cereal-legume cropping systems, cowpea hay led to live-weight gains of 280 to 373 g/d, depending on the cropping system (Umunna et al., 1997). In calves fed teff straw, cowpea hay supplemented at up to 1.5% BW was found as efficient as lablab hay (*Lablab purpureus*) to improve DM intake, rumen ammonia concentration and teff straw degradability (Abule et al., 1995). In India, cowpea hay was fed *ad libitum* to lambs supplemented with barley grain (Singh et al., 2010). In Zimbabwe, it was used as a supplement (at 30% of the diet) to improve ME intake and microbial protein supply when the lambs consume low-quality forages such as maize stover (Chakeredza et al., 2002). In South Africa, cowpea hay was given as a supplement (50, 100, 150 and 200 g/day) to Pedi goats fed *ad libitum* buffalo grass hay (*Paspalum conjugatum*). Some cultivars had high amounts of condensed tannins, but these did not exert negative effects on intake and digestibility (Ravhuhali et al., 2011).

Pigs

Cowpea leaf meal

Cowpea forage can be a valuable source of protein for pigs, though its level of fibre and NDF-bound N (from 24 to 40% N) are limiting (Heinritz et al., 2012; Mastrapa et al., 2000). In one trial, cowpea leaf meal was well accepted by pigs and it was possible to include it at up to 30% in the diet without affecting the digestibility of DM and energy, and with an increase in feed intake. However, protein digestibility decreased (Sarria et al., 2010).

Cowpea silage

In a comparison of several South American legume forages, using an *in vitro* digestibility test based on porcine pancreatin, cowpea silage had the highest digestibility (52%). Using cowpea silage in a mixture (40:60) with maize grain increased *in vitro* digestibility up to 73% (Heinritz et al., 2012).

Cowpea hay

Cowpea hay mixed with ground maize was reported to be quite satisfactory for brood sows (Göhl, 1982).

Poultry

The high fibre content of cowpea forage limits its value for poultry feeding. Dried cowpea leaves have a high carotenoid content and, therefore, cowpea leaf meal could potentially be used in laying hen feeds to increase yolk coloration (Nielsen et al., 1997).

Rabbits

Fresh cowpea forage

Green cowpea vines or haulms are traditional forage for rabbits in several tropical regions of Asia (India) and Africa (Uganda, Nigeria) (Owen, 1981; Lukefahr, 1998; Ghosh et al., 2008; Mailafia et al., 2010).

Cowpea hay and haulms

When cowpea hay is dried in good conditions, with a minimum of leaf-shedding, its nutritive value is equivalent to that of alfalfa as a source of protein and fibre. As with other forages, the nutritive value of the forage is higher at the flowering stage than at maturity (Oyawoye et al., 1990). The amino acid profile of cowpea forage protein is notably deficient in lysine and sulphur-containing amino acids (covering only 60-65% of the requirements of the growing rabbit) but with a high threonine content, which covers 110% of requirements. When only few leaves remain after drying, the protein content may decrease from 18-19% down to 6-8% DM, transforming cowpea haulms into a source of fibre low in protein (Mokoboki et al., 2000; Singh et al., 2003).

In India, cowpea hay is considered as a traditional source of protein and fibre for rabbits. For instance, cowpea hay has been included at 15% in experimental control diets (Prasad et al., 1996a; Tripathi et al., 2008). In studies aiming to determine the optimum protein and energy supply for growing rabbits or breeding does, the level of cowpea hay was increased without problems up to 35% (Prasad et al., 1996b; Prasad et al., 1998). In Nigeria, cowpea haulms (17% protein and 21% crude fibre) included at 50% of the diet resulted in a growth rate similar to that obtained with peanut haulms or wheat bran included at the same level (Aduku et al., 1986). A similar result was obtained with cowpea haulms containing slightly less protein (14% protein and 22% crude fibre) in a study where concentrate and forage were offered separately (Alli-Balogun et al., 2003). Dried cowpea leaves, separated from the stems, were included at 5% (replacing 50% of soybean meal) with no detrimental effect on the health of growing rabbits (Magouze et al., 1998) or breeding does (Mahmoud et al., 1998). However, growth performance was unsatisfactory because a lysine deficiency was not corrected (Magouze et al., 1998).

Cowpea pod husks

The nutritive value of cowpea pod husks for rabbits was largely improved in diets where 2/3 of the cowpea husks were treated with urea (24 h in water with 1% or 3% fertilizer grade urea, followed by sun-drying). Urea treatment resulted in a significant increase in the digestibility of the diet DM (+ 14% and + 26% with 1 or 3% urea, respectively) and of the nutrients. An effect of the presence of urea as a protein source could not be excluded as the dietary crude protein level was increased from the low value of 12% DM in the control diet up to 18% DM in the diet containing 3% cowpea husks treated with 3% urea (Oluokun, 2005).

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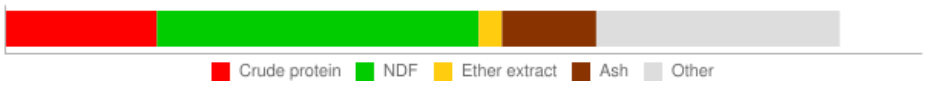
- Cowpea (Vigna unguiculata), pod husks

Avg: average or predicted value; SD: standard deviation; Min: minimum value; Max: maximum value; Nb: number of values (samples) used

Cowpea (Vigna unguiculata), aerial part, fresh



Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	20.9	5.6	11.1	26.4	9
Crude protein	% DM	18.1	2.8	13.5	24.3	24
Crude fibre	% DM	24.1	6.1	11.5	35.9	18
NDF	% DM	38.6	6.6	28.4	55.0	13
ADF	% DM	27.1	6.8	17.8	40.4	14
Lignin	% DM	4.6	1.4	3.9	7.2	5
Ether extract	% DM	2.8	0.9	1.3	4.1	12
Ash	% DM	11.3	1.9	8.1	14.4	17
Water-soluble carbohydrates	% DM	5.1				1
Gross energy	MJ/kg DM	18.1		18.1	19.1	2 *

Minerals	Unit	Avg	SD	Min	Max	Nb
Calcium	g/kg DM	12.5	4.7	6.8	20.6	8
Phosphorus	g/kg DM	2.4	1.1	1.1	5.2	12
Potassium	g/kg DM	19.1	6.9	10.9	31.6	6
Magnesium	g/kg DM	3.1	1.0	1.9	5.0	7
Zinc	mg/kg DM	46				1
Copper	mg/kg DM	30				1
Iron	mg/kg DM	1690				1

Amino acids	Unit	Avg	SD	Min	Max	Nb
Arginine	% protein	4.6				1
Cystine	% protein	0.9		0.9	0.9	2
Glycine	% protein	4.8				1
Histidine	% protein	1.8				1
Isoleucine	% protein	4.3				1
Leucine	% protein	7.4				1
Lysine	% protein	3.3		3.0	3.5	2
Methionine	% protein	1.4		1.0	1.8	2
Phenylalanine	% protein	4.6				1
Threonine	% protein	4.0		3.4	4.6	2
Tryptophan	% protein	1.3		1.3	1.4	2
Tyrosine	% protein	3.2				1
Valine	% protein	5.3				1

Secondary metabolites	Unit	Avg	SD	Min	Max	Nb
Tannins (eq. tannic acid)	g/kg DM	1.8				1

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	71.2				*
Energy digestibility, ruminants	%	68.0				*
DE ruminants	MJ/kg DM	12.3				*
ME ruminants	MJ/kg DM	9.8				*
Nitrogen digestibility, ruminants	%	70.0				1

a (N)	%	37.4	37.0	37.7	2
b (N)	%	60.4	53.2	67.6	2
c (N)	h-1	0.046	0.039	0.054	2
Nitrogen degradability (effective, k=4%)	%	70	64	76	2 *
Nitrogen degradability (effective, k=6%)	%	64	59	69	2 *

The asterisk * indicates that the average value was obtained by an equation.

References

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Cowpea (Vigna unguiculata), aerial part, dehydrated

Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	92.5	3.4	88.5	94.5	3
Crude protein	% DM	17.1	1.2	16.1	18.5	3
NDF	% DM	43.2	3.9	40.1	47.5	3
ADF	% DM	32.8	5.7	26.3	36.7	3
Lignin	% DM	8.4	1.6	6.9	10.1	3
Ash	% DM	15.8		13.4	18.1	2
Gross energy	MJ/kg DM	12.6				1

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	61.1				*
Energy digestibility, ruminants	%	58.4				*
DE ruminants	MJ/kg DM	7.3				*

Pig nutritive values	Unit	Avg	SD	Min	Max	Nb
Energy digestibility, growing pig	%	41.6				1
DE growing pig	MJ/kg DM	5.2				*
Nitrogen digestibility, growing pig	%	53.4				1

The asterisk * indicates that the average value was obtained by an equation.

References

Koralagama et al., 2008; Sarria et al., 2010

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Cowpea (Vigna unguiculata), haulms

Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	95.0	0.9	93.0	96.0	24
Crude protein	% DM	13.7	2.9	6.9	18.0	61
Crude fibre	% DM	29.9	6.6	18.1	44.8	31
NDF	% DM	49.0	8.5	38.1	64.5	38
ADF	% DM	35.4	6.3	25.4	49.1	40
Lignin	% DM	8.5	3.9	4.9	19.4	39
Ether extract	% DM	2.2	0.7	1.3	3.7	25
Ash	% DM	11.0	2.8	6.8	15.9	53
Gross energy	MJ/kg DM	17.9	0.9	17.6	19.6	5 *

Minerals	Unit	Avg	SD	Min	Max	Nb
Calcium	g/kg DM	11.4	3.5	6.4	22.3	20
Phosphorus	g/kg DM	2.6	1.1	1.5	5.1	20
Potassium	g/kg DM	15.1	4.7	8.8	25.8	19
Sodium	g/kg DM	0.7	0.6	0.2	2.2	11
Magnesium	g/kg DM	5.6	1.1	3.6	7.3	19
Manganese	mg/kg DM	129	125	7	301	11
Zinc	mg/kg DM	33	29	1	77	12
Copper	mg/kg DM	8	2	5	12	8
Iron	mg/kg DM	1	0	0	1	4

Secondary metabolites	Unit	Avg	SD	Min	Max	Nb
Tannins (eq. tannic acid)	g/kg DM	2.8	0.9	1.9	3.8	4
Tannins, condensed (eq. catechin)	g/kg DM	0.3	0.3	0.0	0.7	11

In vitro digestibility and solubility	Unit	Avg	SD	Min	Max	Nb
OM digestibility, pepsin-cellulase	%	69.1	5.9	54.7	75.0	19

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	65.3		58.0	65.3	2 *
Energy digestibility, ruminants	%	62.4				*
DE ruminants	MJ/kg DM	11.2				*
ME ruminants	MJ/kg DM	9.0				*
Nitrogen digestibility, ruminants	%	67.6		62.0	73.1	2

The asterisk * indicates that the average value was obtained by an equation.

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Anele et al., 2011; Anele et al., 2012; Blair Ralns, 1963; CIRAD, 1991; CIRAD, 2008; FUSAGx/CRAW, 2009; Mokoboki et al., 2000; Onwuka et al., 1997; Richard et al., 1989; Savadogo et al., 2000

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Cowpea (Vigna unguiculata), hay

Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	91.2	2.0	86.7	96.2	18
Crude protein	% DM	14.8	3.3	9.9	22.9	20
Crude fibre	% DM	32.6	6.8	21.1	43.3	11
NDF	% DM	49.0	5.3	42.6	59.2	17
ADF	% DM	37.2	5.2	28.6	46.8	17
Lignin	% DM	8.0	1.7	4.1	11.2	16
Ether extract	% DM	1.7	0.5	1.1	2.6	11
Ash	% DM	13.7	2.7	8.9	18.7	19
Gross energy	MJ/kg DM	17.5	0.7	16.9	18.7	5 *

Minerals	Unit	Avg	SD	Min	Max	Nb
Calcium	g/kg DM	13.1	3.1	7.2	17.0	14
Phosphorus	g/kg DM	3.9	1.6	1.1	5.6	14
Potassium	g/kg DM	33.2	10.0	11.7	45.3	9
Sodium	g/kg DM	2.6		1.2	4.1	2
Magnesium	g/kg DM	6.6	1.6	4.2	9.2	10
Manganese	mg/kg DM	97	27	70	124	3
Zinc	mg/kg DM	56	20	40	79	3
Copper	mg/kg DM	6	1	5	7	3

Secondary metabolites	Unit	Avg	SD	Min	Max	Nb
Tannins, condensed (eq. catechin)	g/kg DM	4.8	7.7	0.1	18.0	6

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	59.7				*
Energy digestibility, ruminants	%	56.2				*
DE ruminants	MJ/kg DM	9.9				*
ME ruminants	MJ/kg DM	7.8				*
Nitrogen digestibility, ruminants	%	64.1				1
a (N)	%	24.2				1
b (N)	%	63.4				1
c (N)	h-1	0.068				1
Nitrogen degradability (effective, k=4%)	%	64				*
Nitrogen degradability (effective, k=6%)	%	58				*

The asterisk * indicates that the average value was obtained by an equation.

References

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Cowpea (Vigna unguiculata), pod husks

Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	51.6		51.6	92.6	2 *
Crude protein	% DM	12.7		12.4	13.0	2
Crude fibre	% DM	31.8		30.3	33.4	2
NDF	% DM	54.2				1
ADF	% DM	41.1				1
Ether extract	% DM	0.7		0.7	0.7	2
Ash	% DM	7.9		7.2	8.7	2
Gross energy	MJ/kg DM	18.2				*

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	51.6				*
Energy digestibility, ruminants	%	49.4				*
DE ruminants	MJ/kg DM	9.0				*
ME ruminants	MJ/kg DM	7.2				*

The asterisk * indicates that the average value was obtained by an equation.

References

CIRAD, 1991; Oluokun, 2005; Oyenuga, 1968

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- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

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- Animal by-products
- Dairy products/by-products
- Animal fats and oils
- Insects

Other feeds
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- Other products

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Cowpea (Vigna unguiculata) forage

Description | Nutritional aspects | Nutritional tables | References

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English correction by Tim Smith (Animal Science consultant) and Hélène Thiollet (AFZ)

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